## "QUIZ" for Lecture 8

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**E-MAIL SCANNED .pdf OF COMPLETED QUIZ to DrZcalc3@gmail.com (Attachment: qXFirstLast.pdf) ASAP BUT NO LATER THAN Oct. 1, 2020, 8:00pm**

**1.** Find the directional derivative of the function $f(x, y, z) = xy^2z^3$ at the point $(2, 1, 1)$ in the direction $\langle 2, -1, -1 \rangle$.

$f_x = y^2z^3$

$f_y = 2yxz^3$

$f_z = xy^23z^2$

$\nabla f = \langle y^2z^3, 2yxz^3, xy^23z^2 \rangle$

$|\langle 2, -1, -1 \rangle| = \sqrt{6} \longrightarrow u = \sqrt{6} \cdot \langle 2, -1, -1 \rangle = \langle 2\sqrt{6}, -\sqrt{6}, -\sqrt{6} \rangle$

$\nabla f(2, 1, 1) = \langle 1, 4, 6 \rangle$

$\nabla f \cdot u = \langle 1, 4, 6 \rangle \cdot \langle 2\sqrt{6}, -\sqrt{6}, -\sqrt{6} \rangle$

$\qquad = 2\sqrt{6} + -4\sqrt{6}, -6\sqrt{6}$

$\qquad = -8\sqrt{6}$

**2.** Find the maximum rate of change of $f(x, y) = x^2 + y^3$ at the point $(2, 1)$ and the direction in which is occurs.

$f_x = 2x$

$f_y = 3y^2$

$\nabla f = \langle 2x, 3y^2 \rangle$

$\nabla f(2, 1) = \langle 4, 3 \rangle$

$|\langle 4, 3 \rangle| = \sqrt{25} = 5$

∴ The max. rate of change is 5 in the direction $\langle 4, 3 \rangle$.